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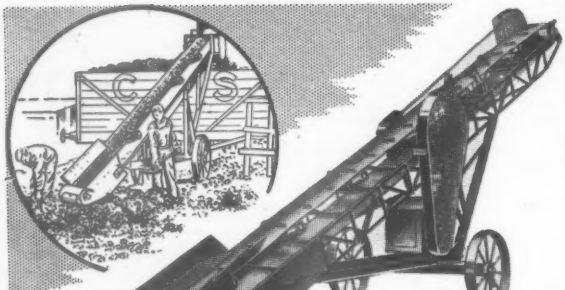

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F.B.I. and Research

It would be difficult to envisage a better statement on past, present and future industrial research activities than the one just issued by the Federation of British Industries from 21, Tothill Street, London, S.W.1, carrying the caption "Industry and Research." The weakness of the Report is the tacit understanding that with increased research facilities, there will arise an adequate number of people capable of directing their activities. Moreover, it cannot be taken for granted the enhanced educational facilities envisaged by the White Paper will of necessity produce original thinkers, though it should yield a higher average level of intelligence. There is no evidence that, with the growth of the modern University, there has been a corresponding output of original thinkers, due possibly to the fact that they have failed to attract the outstanding brilliant students from the public and secondary schools, who instinctively prefer the atmosphere of Oxford and Cambridge. Thus leadership in research will have to compete with the liberal professions for the acquisition of "brilliance," of which there is not an unlimited quantity. Of the six recommendations postulated, the first—urging all firms to do their part, and the second, a plea for adequate support of the co-operative research associations—have been covered editorially by us on numerous occasions. The third one relates to the organisation of a co-operative research association, where an industry has hitherto taken no steps, whilst the fourth calls for an extension of the group system by the Department of Scientific and Industrial Research to *de facto* though unchristened research organisations, coupled with continuous rather than contingent financial assistance. The fifth recommends the Government to allocate a million pounds annually to the D.S.I.R. It is the last recommendation which is the most interesting. Its wording is not so important to our mind as the argument which leads to its postulation. This takes cognisance of American conditions, where the system operated is quite different from ours. In the States, research organisations such as the Mellon Institute are handsomely endowed and brilliantly equipped. Here are carried out investigations for any organisation or concern which cares to pay a quota for its prosecution. The sponsor, we believe, retains patent rights and commercial ownership in any results which may be of a worth-while character. The obvious advantage of such bodies is that the scientific officers are constantly being reinforced in their general outlook by having to give their attention to problems emanating from widely divergent industries. Such a system overcomes the many disabilities to be associated with the request by an individual member to the director of his co-operative research organisation to undertake a particular investigation. They are so obvious as to require no argument for their development. On the basis of our opening remarks, we believe it is essential to foster by all means the atmosphere and traditions of the older Universities and certain world-renowned faculties of the newer ones, for these have been proved to be fertile grounds for the training of personalities with a genius for original thought, bearing in mind that over-dilution of a bottle of whisky reduces the "kick." Unfortunately, the mass production of real intelligence is not yet possible, not even by raising the average intelligence of the masses.

An Appeal.—Mrs. Ethel Rawden, who is well known in South Wales foundry industry circles, is as secretary for the Wales and Monmouthshire Regional Council for the Blind making a special appeal to foundrymen to help to purchase a mansion to be used as a permanent home for the evacuated blind from London and elsewhere. Subscriptions and inquiries should be addressed to Mrs. Rawden, 12, Clifton Place, Newport, Mon.

Contents

F.B.I. and Research, 197.—Correspondence, 198.—Publications Received, 198.—The Production of Air-Cooled Cylinders, 199.—Beryllium, 205.—The Repair of O.-H. Bottoms, 206.—Metallurgical Factors of Importance to the Practical Aluminium Founder, 207.—Notes from the Branches, 212.—Dorman Long Capital, 212.—Contract Open, 212.—Personal, 214.—Company Results, 214.—Obituary, 214.—Control of Iron and Steel, 216.—News in Brief, 216.—New Trade Marks, 216.—Raw Material Markets 218.

CORRESPONDENCE

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

IDENTIFYING EARLIER COSTINGS

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—Your correspondent, "Lancashire Foundry Owner," has set a most interesting problem in asking your readers for ideas for the identification of past quotations.

From the writer's experience, the card index system is by far the simplest method of easy reference. The compiling of this involves, first, a definite factor—usually a numeral or letter. In your correspondent's case, however, these do not appear to exist. Any casting, however, can be identified by actual or estimated weight. This, then, can be used for the index cards. For example, castings weighing up to 1 ton, the cards can be marked from 0 up to 20. Between the index 0 to 1 records of castings would be those weighing up to 1 cwt. and so on. Where large numbers of records are involved, the splitting up of the records into sections will speed up by as many times as the number of sections used in the location of the required card. Where there are only a few types of castings, such as wheels, covers, levers, etc., these types can form the sections. If a large variety of castings is being handled, a classification by letter could be employed, such as A, B, and C, according to the intricacy or plainness of the castings.

I would point out to your correspondent that the above remarks are not based upon actual experience, but upon the methods I would adopt if asked to make an easy reference of, say, 100 different patterns and given their actual or estimated weights.—Yours, etc.,

R. F. COATES.

94, Brunswick Road, Ipswich.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—Referring to the letter from "Lancashire Foundry Owner" in your issue dated October 28, 1943, a card system can be used indexed under Pattern Numbers, Names of Firms, or Names of Castings, such as pipes, pullevs, machine bases, angle brackets, jigs, etc. The two former would be of no use for the purpose required, and the usefulness of the latter would depend to a large extent on the person keeping the records.

For example, an angle bracket to one person would be a fixing to another, and a wall bracket may similarly be called a bracket. Generally speaking, however, the latter method could be made to serve the purpose, and it would be found eventually that each class could be sub-divided Pipes could be separated first in sizes as 2-in., 2½-in., 3-in., etc., and then further sub-divided as elbows, "S" bends, etc. Similarly, wall brackets could be classified according to size, 12-in., 18-in., 24-in., etc.—Yours, etc.,

"FOUNDRYMAN."

November 2, 1943.

PUBLICATIONS RECEIVED

Economy Measures to be Observed in the Use of Lubricating and Industrial Oils. Issued by the Ministry of Fuel and Power.

This 12-page pamphlet is divided into three sections:—(1) Received and storing; (2) issue and application; and (3) reconditioning and recovery. The advice it contains is sensible, simple and effective, and is well worth study by our readers. Two-colour printing has been resorted to, accompanied by much unnecessary showmanship. If this had been eliminated, the pamphlet could easily have been compressed into eight pages. After all, paper, too, should be saved!

Memorandum on Projection Welding, and **Memorandum on Resisting Welding Process.** Issued by the Advisory Service on Welding, Department of the Director-General of Scientific Research and Development, Ministry of Supply, Berkeley Court, Glentworth Street, London, N.W.1

These two booklets, which are admirably illustrated, are in every way excellent. By starting with the one on resisting welding, and continuing through to the end of projection welding, the reader will have gained as complete a picture as possible of the technique and usefulness of these two closely related subjects. A number of illustrations are given showing how, by the use of rotary tables, the processes can be more or less mechanised. The available literature on this particular type of welding is very small compared with that devoted to fusion welding, and publication of these two booklets will fill a long-felt want in welding circles—especially amongst the higher grade of technicians—as their automatic character leaves but little discretion to the operator. Those operating the comparatively new technique of welding are fortunate when compared with the craftsmen in the older industries in being so well catered for by Government departments, for earlier publications emanating from this source were of similar excellence.

The Nickel Bulletin for October includes abstracts on complex nickel-aluminium-iron magnet alloys, the effect of hydrogen on ferrous castings, weldability tests, and the use and misuse of the salt spray test. Copies may be obtained, free of charge, from the Bureau of Information on Nickel, the Mond Nickel Company, Limited, Grosvenor House, Park Lane, London, W.1.

B.C.I.R.A. New Members.—The following firms have joined the British Cast Iron Research Association. Between brackets the name of the accredited representative is given:—Baker's Foundry Company, Limited, Smethwick (Mr. A. E. Lester); Hepworth & Grandage, Limited, Bradford (Mr. H. Forrest); Rose, Downs & Thompson, Limited, Hull (Mr. L. H. Downs); Harry Summersgill, Bradford (Mr. H. Summersgill); Warner & Company, Limited, Middlesbrough (Mr. D. O. Sillars). Two Associates have also joined:—Mr. Eric Heap, of Chesterfield; and Mr. A. G. F. Cusworth, of Sheffield.

THE PRODUCTION OF AIR-COOLED CYLINDERS*

An account of modern practice from pattern to final casting with special reference to sand problems

By T. H. TAFT

Automobile castings, as a whole, are known to be amongst the most difficult castings to produce, and in this specialised branch of the foundry industry, air-cooled cylinders have their own very special problems. One of the main difficulties (due to the intricate shape of the castings, as shown in Fig. 1), is that practically all moulds have to be stoved. It is not inferred that the methods adopted to produce air-cooled cylinders by the company with which the author is associated are necessarily the best. He has been extremely interested in the methods[1] adopted by American foundries producing aluminium air-cooled cylinders of an intricate type, but allowing for the very high rate of production which is required, to make the cylinder described later would mean that sand and drying costs would be so high as to be prohibitive. These aluminium cylinder heads are used on Wright's radial engines, and consist of very fine pitch fins up to 3 in. deep. In the American method of manufacture, 750 pins are placed in each half-mould, and

FIG. 1.—GROUP OF TYPICAL CASTINGS.

the complete mould weighs over 400 lbs. The time for drying is given as 7 hrs. at 450 deg. F. (230 deg. C.). If a similar method were adopted for making the side valve cylinder, the sand mound would weigh about 120 lbs., and would take about 5 to 6 hrs. to dry. What troubles would arise from the gas evolved, due to the higher pouring temperature of cast iron, it is difficult to say, but in view of past experience, trouble could be expected from this source.

Pattern Equipment

Good castings can never be made quickly from indifferent pattern equipment, and it cannot be overemphasised that air-cooled cylinder patterns must be first class. A master pattern is made usually in pine, as this wood tends to give less trouble from warping; aluminium, brass or bronze castings are finished off for production patterns. An example of the fine limits required, shown in Fig. 2, is a 3-in. dia. bore cylinder with ¼-in. wall, having 1½-in. fins, which are ¼ in. at the root and $\frac{3}{32}$ in. at the tip, and give a taper for drawing of $\frac{1}{32}$ in. This is not too bad, but at the joint line, where the draw is 3 in., 0.011 in. taper to the inch, and half-way to the edge 2-in. draw, 0.007-in. taper to the inch is pretty fine work. When finishing off the pattern, great care obviously has to be taken, to avoid undercuts.

The foregoing may not be so important for hand-moulded work, which is usually well rapped and knocked down, but, where dimensional accuracy is

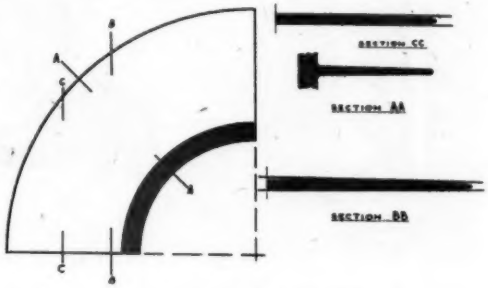

FIG. 2.—SHOWING FIN SECTION.

required, personal opinion is that machine moulding is essential. Stripping plates are never used unless every other method has failed to give the required result. These patterns or coreboxes are constructed so that the fins are made separately from the body, and fixed together, as shown on Fig. 3, with parts dismantled. The body, which usually forms the radius at the bottom of the fins, is also held together by a series of spacing pieces; both these parts are separate from one another. Each part, however, must fit into the other with the minimum clearance to avoid sand getting between the joints.

Fig. 4 shows corebox complete with sand core. The advantages are that the sand can be rammed to the maximum density, the pattern or corebox does not require rapping before drawing, and a core true to size is obtained. The claim made for this type of equipment that unskilled labour can be used has not been substantiated. It has been proved that all other things being equal, the use of stripping plates has

* A Paper read before the Birmingham, Coventry and West Midlands Branch of the Institute of British Foundrymen, Mr. T. M Gameson presiding.

Casting Air-Cooled Cylinders

not increased production. Some manufacturers insist on jigging off fins for the first machining operation, and occasionally, under these circumstances, recourse has to be made to stripping plates.

The preparation of this type of equipment is both tedious and expensive, and it is very apt to wear rapidly, due to the abrasion of the sand. A method adopted to reduce this wear is to chromium-plate these parts, and this has proved very effective.

Coreboxes

Cast iron is used as often as possible, the extra cost of finishing being more than compensated by reduced wear. Constant sleeking off, even in this material, causes the faces of the boxes to wear hollow. A point which may be of interest is that cast-iron coreboxes have been recovered by welding along the face with low-carbon steel, and then grinding to finished size. This seems to be much more effective than using hardened steel plates, which have to be used on aluminium coreboxes. No trouble has been experienced from distortion, and this, it is thought, is due to the use of a high-duty cast iron containing nickel and molybdenum, which has a Brinell hardness of 270. The patternmakers express the opinion, however, that it works up just as well as ordinary cast iron, except that it is a little tougher.

Moulding Boxes and Core Plates

The necessity for using boxes that are rigid and accurate, and core plates that remain flat, is obvious. The larger proportion of the castings have to be cast vertically, and boxes must be bolted or clamped tightly into position before putting down for casting. All boxes are interchangeable, but due to pouring holes (used sometimes for special jobs) being cut on the long side, boxes that are fixed by clamps have to be made with a double set, and clamped on opposite corners instead of in the middle. Every time a box is stoved, an oxide skin forms, and in a surprisingly short time it becomes useless; steel boxes seem worse than cast iron in this respect, and although galvanised boxes are in use with satisfactory results, trouble is experienced after a while, with the fins fitting loosely. Boxes rebushed with stainless iron over five years ago have not worn at all. Boxes made up specially with heavy-section high-carbon steel, weighing nearly as much as cast iron of the same size, become distorted after a time, due to rough usage, and in view of the cost entailed in resetting at intervals, it is probable that a well designed alloy cast-iron box is the answer. At least it is known that boxes, once having passed on the jig, are true to size, until some heavy-handed individual distorts them.

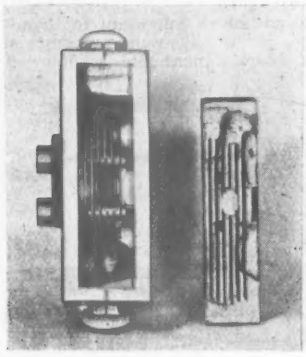

FIG. 3.—STRIPPING PLATE COREBOX ASSEMBLED WITH SAND CORE.

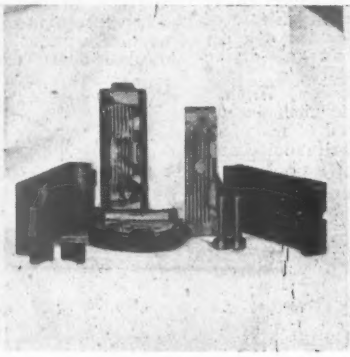

FIG. 4.—STRIPPING PLATE COREBOX DISMANTLED AFTER CORE IS MADE.

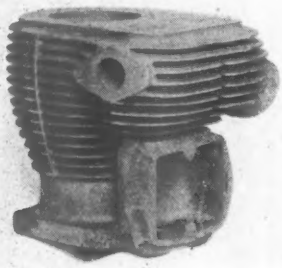

FIG. 5.—SIDE VALVE CYLINDER CASTING.

Sand

The basis of all sand used is Congleton silica sand. This is a similar sand to Southport, but contains a small amount of clay. The mechanical analysis given on Table I shows that the main sizes are spread over four sieves. This, together with the fact that a larger percentage of fines are present, gives a sand with good moulding properties, and a less harsh feel than that of Southport. Another important factor is that the chemical analysis shows an almost pure silica sand, which is of importance if sand recovery by burning is contemplated at any future date. Oil sand is used for the facing of all dried moulds, the mixture being made up of 60 per cent. recovered black sand, 40 per cent. new sand, and lightly milled to give

a medium green bond. The same mixture milled for a longer period is used for making plain body cores and barrel cores.

Finned cores, and any cores which have to be packed, are made in new sand. All mixtures contain 0.75 per cent. dextrine, 0.75 per cent. linseed and 0.25 per cent. water. The physical properties of this sand are shown in Table II. The sand is mixed in Pneulec 6-ft. mills, of 672 lbs. capacity, and 500-lb. batches are used for oil sand. This, it is thought, helps to give an intimate mixture, which is necessary in view of the small amount of dextrine and linseed used. The new sand and medium black sand is milled for 4 min., and the stronger green bond black sand for 6 min. The sand is completely free from any stickiness during working.

All patterns and coreboxes develop an extremely high polish, and are very seldom cleaned. This is an

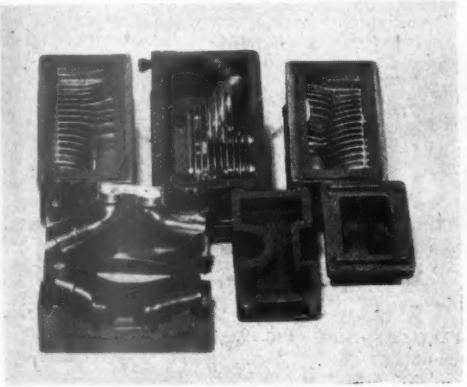

FIG. 6.—SET OF COREBOXES USED IN PRODUCTION OF SIDE VALVE CASTING.

essential feature when making finned work of this type. On our air-cooled cylinder production, a scrap casting from blowing trouble is a rare sight. The skin-drying properties of the mix are invaluable, as cores and moulds form a hard surface in a very short time, and assist the fins of sand to retain their shape while being taken to the stove, and, further, hold their shape until dried. Moulds and cores are dried in Acme vertical continuous stoves. Small and medium cores are dried for 1 hr. 10 min. at 550 deg. F. (285 deg. C.); and large cores and small moulds for 1 hr. 25 min. at 550 deg. F. Large moulds are dried on an automatic loader and unloader type stove for 1 hr. 35 min., at 600 deg. F. (315 deg. C.).

All moulds—and some cores—are sprayed with blacking while green. During the early days, when experimenting with recovered and new sand, the green bond developed without any further addition of dextrine was apparently sufficient for moulding, but a great deal of trouble was encountered with bad lifts. The explanation may be that the most important function of dextrine is that of providing plasticity rather than green bond. A special technique has to be employed for mixing the sand. To keep the green bond on the low side, oil and dextrine are put in first, and when thoroughly mixed the water is added, and before the sand gets too tough the mill is emptied. Sand of the correct flowability is obtained in this manner. No matter how skilled the operator, a closely packed mould cannot be made if the sand is too tough.

These terms are used, of course, only relative to the particular sand under review; a similar flowability is obtained with a natural bonded sand of 15 lbs. green bond, and, to digress further, the black

TABLE I.—*Mechanical Analysis of Congleton Sand, Together with Southport Sand for Comparison.*

	Congleton.	Southport.
	Per cent.	Per cent.
+ 22 mesh	0.5	Nil
+ 30 „	2.2	Nil
+ 44 „	9.7	Nil
+ 60 „	38.0	9.5
+100 „	40.1	76.3
+150 „	7.5	13.9
+200 „	1.1	0.2
−200 „	0.6	Nil
Clay	0.3	0.1

TABLE II.—*Physical Properties of the Sands Used.*
(Laboratory Dried and Tested.)

	Standard Sand Mixture.			Backing Sand.
	0·75 dextrine, 0·75 linseed, 0·25 water.			0·65 Bondol, 1½ per cent. Fulbond, 3 per cent. water.
	New sand.	60 per cent. blk., 40 per cent. new, milled 3 mins.	60 per cent. blk., 40 per cent. new, milled 6 mins.	
Green permeability ..	123	108	101	73
Green compression, lb. per sq. inch ..	0.25	1.6	3.1	8.8
Dry tensile, lb. per sq. inch, 1 hr. 450° F.	321	152	180	10
Dry tensile, lb. per sq. inch, 1½ hrs. 450° F.	348	122	162	10
Dry compression, 1 hr. 450° F.	—	—	—	80

Casting Air-Cooled Cylinders

sand used for making green-sand work is useless if above 7 lbs. green bond, should a good surface finish be required on the castings. A *true* flowability test which would indicate these differences would be invaluable. No apology is made for stressing the sand question, and instead it is stressed that the successful production of these castings depends on getting the sand correct, and keeping it so. To do this, it is preferable to check the sand by regular control tests, as in the author's case, due to the small margin of safety, production depends on all mixtures being correct. A general impression seems to be that synthetic sand is difficult to control, and as moulders do not take too kindly to its use, many people will not take the plunge and introduce it, on the assumption that it is necessary to make a big change-over.

the different sands used were being kept separate, sand tests showed the permeability figure slowly, but surely, getting lower. One or two friends ascribed the trouble to silt. The author could not accept this view, as he had sufficient faith in the early experiments to disregard this theory. The trouble was eventually traced to the runner bushes, which were being made in the naturally bonded black sand. It seems fairly obvious now that this could cause trouble, but at the time the relatively small amounts going in were not thought to be capable of exerting such an influence. The cure was for the whole of the bushes to be made in synthetic sand.

At that time a heavy type pug mill was being used for preparing the naturally bonded facing sand, and, with a mixture of six shovels of red and eight of black, the milling time required to turn out the sand in condition for moulding was 15 to 20 min. The mixture was altered to 1½ shovels of red, 3 per cent.

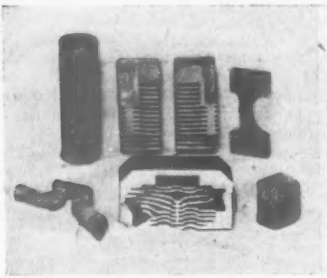

FIG. 7.—SET OF CORES MADE FROM EQUIPMENT SHOWN IN FIG. 6.

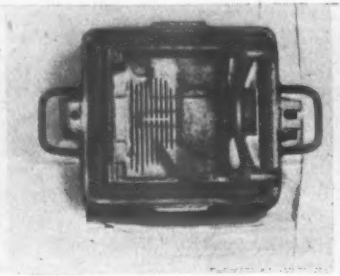

FIG. 8.—BOTTOM PART OF MOULD.

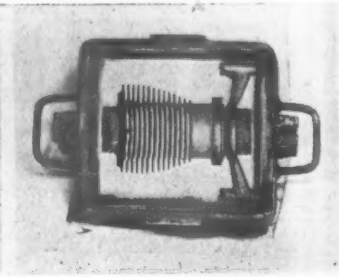

FIG. 9.—TOP PART OF MOULD.

Change-over to Synthetic Sands

A short account of how the change was effected in this foundry will, probably, dispel this idea. Eight years ago the backing sand was very close with a permeability of 30; drying trouble, already acute, was becoming worse. About this time a Paper[3] by J. J. Sheehan had been published, and from the information given, it was thought that some benefit might be gained by using a more open sand. The knock-out sand from the castings made with oil-sand facing was recovered, bonded with clay, and used as backing sand. A permeability of 100 was obtained in this manner, and was found to halve the drying time. The larger proportion of castings was still being made in red sand, and, unless strict supervision was kept, a certain amount of burnt red sand got into the new backing sand and reduced the permeability to about 50.

Special care in keeping the two types of sand apart had the effect of restoring the open sand to its original condition a little time later. No further troubles cropped up for some months, but although clay, and the balance black; it was milled 6 to 7 min. At one time the foundry received no new red sand for four days, and no complaint was made until one of the moulders noticed the absence of red sand. This led to an immediate outburst to the effect that the sand was useless without some red sand. A week later, for some days all red sand was left out, but red dye was added which gave the appearance of having more red sand than usual, and the only comments made were favourable.

Relative Advantages and Disadvantages

The reduction of red sand in the facing meant that the backing sand had to be made up with knock-out sand, which included a good proportion of burnt sea sand, but, although quite large quantities were put in, very little improvement showed in the permeability for nearly twelve months, when the figure reached was 35. The final change was then made by holding back a quantity of oil-sand facing from the knock-out (a certain amount of which always has to be carried away), dumping half the naturally

bonded sand and replacing it with knock-out sand, and the foundry was put on a synthetic basis. In two or three weeks the sands were sufficiently mixed to show on tests that the permeability was between 75 and 80. Amongst the points to be made against the use of a synthetic sand is the somewhat rapid drying-off property, due to a rather narrow moisture range, which is especially noticeable if the sand be hot. It must be milled if a good green bond and permeability are required, with a minimum amount of clay, and more plant is required than is usually necessary when using naturally bonded sands. However, assuming that the plant is available and efficient, the only really serious problem is drying off.

In favour of synthetic sand, the following points do, in personal opinion, more than offset the disadvantages. Sand properties are uniformly and closely controlled, less skill required in ramming up moulds, much faster drying rate, due to more open sand, reduced amount of rough fettling, not only because there are many less pins to remove, but the sand is more refractory, does not burn on, and shortens shot-blasting time. Having one sand as a base, all batches can be put through the same mills without cleaning out. Air-cooled castings have to be cast quickly, and naturally there is a big strain on the fins of sand in the mould. A casting can easily be scrapped due to indifferent pouring, and the present methods used show a greater margin of safety. The fact that, apart from drying troubles, the foundry does not see a swelled casting for months at a time, is ample proof to the author that a permeable mould is essential. Scrap up to 5 per cent. from this cause was not considered too bad at one time with close sand. Very few pins are needed to support the fins, and then usually only while the sand is green. In one job, for example, previously 160 pins were used, whereas now about 14 are required. Mould production is much more rapid, and a clean lift is guaranteed owing to the addition of 0.75 per cent. dextrine.

Metal Composition

The analysis shown in Table III is only varied when castings are required for high-pressure work, in which case the phosphorus is reduced to 0.20 per cent. No steel is used in the mixture, mainly because of the difficulties of obtaining a thoroughly homogeneous mixture under existing operating conditions. Castings made in 0.6 phosphorus all show a network of phosphide with a mixture of pearlite and ferrite. The Brinell hardness runs from 210 to 230, usually taken on the holding-down flange. Metal charges normally consist of three brands of pig-iron, two of which are refined iron, and one a straight blast-furnace iron. This is enough to give a good mix, and should any trouble arise, it is fairly easy, by process of elimination, to find out at any time which iron is giving trouble.

TABLE III.—*Standard Analysis.*

Total carbon	3.20
Combined carbon	0.70
Silicon	1.95
Phosphorus	0.60
Manganese	0.75

Whilst not normally having a conservative outlook, this is one item that has to be carefully considered when making a change. It is felt that certain irons have hereditary properties that cannot be explained by analysis. Iron is purchased by analysis and fracture. The straight iron is never used in a proportion greater than 25 per cent., and if this figure be exceeded, open grain and porosity are likely to be experienced in heavy sections. While making high-duty cast iron, in which up to 25 per cent. steel is used, it was decided to see the effect steel had on ordinary mixtures. These were made up for a period of three months, varying the steel content from 12½ to 25 per cent., and keeping the final analysis the same. It seemed that the straight iron could be increased to 33⅓, with 12½ per cent. steel, and still keep heavy sections sound. Sections of castings are extremely varied; it is now quite common to have thin walls of $\frac{5}{32}$ in. thickness, which have to be machined, not ground, running on to heavy sections of ¾ in., and in this latter portion due to the design, the rate of cooling is often very much retarded. Over five years have elapsed since the foundry has had a casting returned for porosity (no pressure testing equipment is available at the foundry), and during this period no serious complaint has been received about machinability.

Cupolas

Two cupolas are lined to 24 in., to a height of 2 ft. 9 in. above the tuyeres, and then flared to 33 in. in the preheating zone. Four tuyeres are used, 5½ in. by 4½ in., giving a ratio of approximately 4¾ to 1. Volume and pressure gauges of Metronic Instrument Company's make are used on both cupolas. Distribution of the air in the cupola is important and continual checks are taken to ensure that an equal volume of air is passed through each tuyere. In this particular case it is very essential, as the lining in the preheating zone is only 3 in. thick, and after only melting about 80 tons, *i.e.*, three weeks' use, 1 to 1½ in. is left at this point. The wear at the superheating zone is regular, and no trouble arises due to localised erosion.

The first blow with a newly prepared lining, on one occasion gave uneven wear at a point just above the tuyeres. This was found to be due to one of the tuyeres being offset about 7½ degrees. Investigation showed that this restricted the air delivered at this tuyere by about 15 per cent. Cases have been known where the tuyeres appeared evenly balanced according to the indication of the control valves, and yet in actual fact showed a variation between the highest and lowest reading of 80 per cent. in the volume of air delivered by each.

The lining is prepared with a proprietary monolithic refractory material, which is rammed round a plug once every 14 days. This is the only material so far found to withstand the temperature in the superheating zone. Silica bricks, high alumina bricks, all melt away about 1 ft. to 2 ft. above the tuyeres.

Normal practice is followed in the preparation of the lining and in repairs. The inside is patched the

Casting Air-Cooled Cylinders

day before the cupola is used, the hot walls help to dry the patching material and a small fire is put in the bottom to complete the drying. Preparing the day before helps to get an early start, this is especially important during the winter months, as the cupolas are not blacked out. After burning up during the morning, the back plate is made up when the fire has burnt up to a height of not more than 12 in. above the tuyeres. The bed is then made up to 42 in. with 5-in. coke, and as soon as the cupola is charged, the blast is put on. If the bed does get thoroughly burnt through, dull metal is obtained, whereas following the above pratice, intricate castings can be poured after about 1½ cwt. has been run through. Nine 4-cwt. charges, consisting of 3 cwt. pig, 1 cwt. own runner scrap, with 60 lbs. coke, and 14 lbs. limestone, are charged to fill the cupola, and this is about one hour's melt. The fan is run to give 1,100 ft. per min. at 8½ ft. w.g. for the first 30 mins., then reduced to 850 ft. per min. at 6 in. w.g., and left at this position for the remainder of the cast.

Melting Conditions

A melting rate of about 35 cwts. an hour is maintained; this seems to be an optimum condition, and if increased to 2 tons an hour, scrap castings through misrunning (although the temperature seems sufficiently high), and gasholes appear. This latter trouble used to occur at one time when using a particular refined iron, which had been produced under conditions of high melting rate.

The essential factor to control is the amount of coke used per hour. Although a rate of melting of 35 cwts. per hour may at first sight appear low, it must be noted that the metal to charge coke ratio is 7.5 to 1. With a similar rate of coke burning and a ratio of 10 to 1, this corresponds to a melting rate of 50 cwts. per hour. To obtain 2 tons per hour with a 7.5 to 1 ratio corresponds with an output of 55 cwts. at a 10 to 1 ratio. Such an output from a 24-in. bore cupola could, in personal opinion, only be obtained by overblowing. The amount of air consumed is low, and suggests, according to published data, that the thermal efficiency is low, nevertheless, metal troubles are very small, and the foundry is melting iron at consistently high temperatures.

One casting (Fig. 5) only has been taken as an example to avoid confusing the issue, with one exception, that a core made from the stripping plate corebox, mentioned previously, is shown. This casting was chosen partly because it really incorporates three methods of production. The top part, as shown in Fig. 9, is moulded in the ordinary way. The middle part is cored out in the normal manner, and the bottom part, as shown on Fig. 8, is made by ramming up the core with the mould. This has to be done to ensure that this front block core is placed correctly, as the valve core is set into this core, and a further core rests on the front portion of this block core. The weight of these moulds ready for casting is 135 lbs., and it is possible to produce 120 castings in an 8-hr. day.

Foundry scrap from all causes amounts to 3.5 per cent., and quite a large proportion of this scrap figure is due to breakages. Return scrap after machining is 1.2 per cent. These figures are taken over the last twelve months. It might appear that some of the operations (illustrated in a film which the author exhibited) are speeded up, but it can be asserted that the movements are as seen, in actual practice. The certainty of obtaining a good lift gives confidence, and a speed of working that would not be reached otherwise. The two cores for the middle portion are made in less than 2½ mins. The usual practice followed takes at least 20 mins. to make the same core. These cores are jigged, and then gauged into the mould. The author deems it to be better in the ordinary way to make the cores with no allowance for jigging, but this is an exceptional case. Casting with a 450-lb. ladle ensures a uniform metal composition, and the drum type ladle holds the temperature longer than the open type.

All fettling and final dressing must be done by hand, and it is fairly obvious if the shape of the casting is taken into consideration.

To conclude the author would like to thank Mr. W. Jackson, of the Idoson Motor Cylinder Co., Ltd., for permission to present this Paper, and the British Cast Iron Research Association, particularly to Mr. L. Bolton and Mr. W. B. Parkes for their kindly interest and constructive criticism.

DISCUSSION

In opening the discussion, MR. A. G. HARRISON proposed a hearty vote of thanks to Mr. Taft, assuring him that they fully appreciated the value of the slides and the films exhibited. The firm were evidently accomplishing a good job of work, as they were keeping their scrap down to such excellent figures.

MR. F. J. COOK, in seconding the motion, remarked that it had often been said in the past they did not get enough practical Papers. He thought Mr. Taft's Paper would satisfy everybody from the practical point of view. He congratulated the author on a series of excellent slides of a difficult subject and also for incorporating a great deal of information in his Paper. If it was published he believed it would be a standard work on the making of those particular cylinders. Looking back he could not find any information regarding that class of work either in the records of the American Foundrymen's Association or those of the Institute. He was convinced that the Paper would fill a long felt want.

MR. TAFT then interposed, and asked members if they could help him solve a problem. One interesting snag facing any engineer in designing an engine was to keep it mechanically quiet, and he had carried out a large number of experiments with a view to reducing the tendency of such cylinders towards resonance. However, he felt he was just groping in the dark, and if anyone could give him a lead he would be glad.

MR. J. J. SHEEHAN said he had no criticism to offer, and he thanked Mr. Taft for his references to himself. He did not think it would be possible to reduce the percentage of oil and dextrine used, and the same was true of the proportion of synthetic sand.

Replying, MR. TAFT said he knew the percentage of synthetic sand was low, but they were rather fussy in regard to mixing, realising that if they went about it in a haphazard manner they would encounter trouble. Although Mr. Sheehan did not think they could reduce the oil and dextrine further, he had been trying to get it down to limit drying time on some particularly heavy jobs. They were not really dry, and, owing to lack of drying, oil was left in the cores. For ordinary purposes it was difficult to cut it down any more.

Resonance and Mechanical Noise

On the question of resonance, MR. SHEEHAN pointed out that an efficient air-cooled engine was bound to produce a certain amount of noise, and springs, etc., amplified the already existing mechanical noises.

MR. TAFT said they were trying to get the least resonance and to cut down the mechanical noise. They found aluminium much worse than cast iron. They believed it could be overcome, but the moulding problems associated with it were extremely difficult.

Replying to questions by other members, MR. TAFT explained that his firm's experience had been that to turn the casting up to pour was the safest way. If cast in the moulded position, the metal did not run clean. Unless it was cast from the centre the structure would be different and the stresses due to different temperatures in the mould would be considerable. He was referring in general to rather intricate types of cylinders. With regard to welding coreboxes he did not know what happened when low-carbon steel was welded on to cast iron, but he presumed it became high-carbon steel. It was intensely hard, and thousands of castings could be made before it was necessary to go through the process again.

MR. A. TIPPER wondered whether core blowing would not enable them to cut out some of the pins.

MR. TAFT, however, pointed out that pins were only put in to hold the fins in the green state, and core-blowing would not get rid of any of them. Asked by Mr. L. W. Bolton if he thought the long fins were really necessary, MR. TAFT said it had been definitely proved that they were not efficient beyond a certain point and were put on for ornament. Most of them were too long to be efficient. In general, if the fins were designed to give the maximum thermal efficiency, much less trouble would arise from resonance.

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SAVE PAPER FOR MUNITIONS

BERYLLIUM

Beryllium is distinctly a modern development. Its major use is in the manufacture of strong, heat-treated copper-base alloys in which the beryllium content varies from about 0.3 to 2.5 per cent. Its present source is the mineral beryl, found in pegmatite, in which, commercially, the beryllium oxide content is about 10 to 12 per cent., or 4 to 5 per cent. of beryllium.

About 2,500 tons of beryl ore is consumed at present and, if supplies are obtainable, 7,000 tons might be used in 1943 and 8,000 tons in 1944. Granting a favourable foreign mining and shipping situation, beryl supplies from known sources may aggregate 6,000 tons in 1943. Most beryllium ore has been obtained as a by-product of mica, lithium, and felspar mining. One-half ton of beryl per 100 tons of rock moved is common.

Beryllium-copper alloys provide a strong, heat-treated metal for electrical contacts, springs, clips, etc. Studies to broaden the use of these alloys because of their valuable properties have now created a demand which tends to exceed the supply. Virtually all beryllium-copper is now going to vital components of direct and indirect military end products. If insufficient supply causes substitutes to be used, phosphor bronze, aluminium bronze and alloy steel, which it has replaced, will probably be used again. Alloys containing less than the conventional 2 per cent. beryllium will suffice for many uses.

Nickel-beryllium alloys have good physical properties, but none not obtainable in other alloys of nickel at lower cost. Magnesium-beryllium alloys are used to some extent for castings, but little beryllium is required for this purpose. The hot strength of aluminium-beryllium alloys is considerably above that of other aluminium alloys. The thermal conductivity is of a high order, and the thermal expansion low.

Beryllium oxide, fired to be used as a refractory material, is strong, hard and resistant to thermal shock. Its melting point of 2,575 deg. C. is about 500 deg. C. higher than that of alumina. It is the most important fluorescent material used in fluorescent lamps.

Beryllium phosphors, which transform radiation of a given wave length into radiation of longer wave length, are now used in about 92 per cent. of the present production of fluorescent lamps. They are also used in X-ray screens, television, and other cathode-ray tubes. The best substitute now known is cadmium, but besides requiring 18 times more cadmium oxide than beryllium oxide, the initial light output is 20 per cent. lower and the maintenance of initial light output is only 73 per cent. of that of the beryllium phosphor at the end of 500 hours. These notes are from a report of the U.S.A. War Metallurgy Committee.

Magnetic Testing of Steel Castings.—The Steel Division Committee of the A.F.A. on Magnetic Powder Tests has analysed 67 replies to questionnaires received from steel foundries covering this subject. Fifty-seven per cent. stated their willingness to accept orders requiring magnetic inspection.

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THE REPAIR OF O.-H. BOTTOMS

AMERICAN EXPERIENCE AND METHODS

Fettling the bottoms of basic open-hearths is often accompanied by a loss of time in actual melting, and in order to reduce these delays various experiments have been carried out in some American works. According to a report in "Steel," the rapid setting of a magnesite repair is hastened by simply having the charging-car operator dip a charging box of liquid slag from a nearby furnace and dump it on the patch in question. The method used in these repair jobs has been discussed with several open-hearth furnacemen, and the general opinion of this new but simple idea is that, with skilled operators, it is entirely practical.

In one case of a charge which had broken out through the bottom, the hole under repair was given a double heavy shot of magnesite, the tap hole was closed and lined up at once. It was then agreed to have the machine man take an old charging box, slag it in the manner of a test-spoon, and attempt a transfer of liquid slag, which was successfully done. The liquid slag dumped in the furnace was cooked for approximately 15 min. before being tapped. Inasmuch as the bottom had a wet and spongy appearance, a couple of applications of magnesite was given to absorb all the excess slag. Shortly thereafter investigation disclosed that the bottom was well bonded and ready for use without even piping the tap hole. The bottom held its contour and hard, solid appearance far longer than usual following such a job. Over 100 heats were tapped before the furnace was taken off for repairs, the patch being in good shape at the end of the campaign.

Liquid-Slag Dumping Method

The liquid slag dumping method also was employed for fixing the breast of the furnace. Damage to the bottom here is more severe because of tearing of the breast by bad scrap, by the falling of fluxes that fail to clear the bank in the door, etc. Hot slag dumped on a magnesite patch at this location helps hasten the job, for this is the coolest part of the furnace and the hardest place to fuse bottom materials. Shortly after the hole is built up level with the original bottom the charging car is brought into play again. This time a box or, preferably, a paddle for charging large pieces is used as a tool to forge and press the breast, and all portions of the banks that can be reached, into the desired contour. Pressing the mixed slag and magnesite hastens the bending of the bottom and never fails to save time on repairs where it can be used.

A magnesite bottom will absorb about 50 per cent. of liquid slag. The quality of the slag is highly suitable for the job when it is dipped liquid hot before any additions of silicon, manganese, coke, limestone, dolomite, etc., are made. Using a liquid instead of small or large particles results in a more uniform absorption.

On minor holes in this shop it has become customary for the helpers to use the explosion method for quick repair of places still retaining metal after the tap. This is an unsafe practice except at the hands of experienced and able operators. The usual practice is for the doorman to raise a door at an angle with the hole to be fixed; then the helpers soak a shovel of magnesite well in the water bosh and heave it directly in the metal. The resultant explosion, caused by the water-soaked magnesite, cleans the hole instantly and still leaves the surrounding bottom hot enough so that the small amount of repairing materials will set to the rest of the furnace bottom material more rapidly than if some other method of cleaning the hole was to be used.

A liquid slag application upon a triple or quadruple shot of magnesite, compared with the method of adding only a few inches of magnesite at a time with the usual mix of ground slag, is of value on deep holes. It not only is a time saver, but affords a more lasting patch.

A Major Problem

A major problem facing the helper in settling the bottom in a deep crater is the fact that the level of the hole is always so much lower than the bottom of the taphole so that when the furnace is fired to a temperature high enough to bond the added materials, the excess slag collecting in the bottom of the hole causes trouble. The operator must keep the bottom of the cavity as level as possible or pools of slag collect and high spots of magnesite are still not properly fused. Attempts to keep a gutter from the crater to the taphole is adversely affected by the depth of the hole. If magnesite is added fast enough to absorb all the slag that tends to run to the centre of the patch, the walls of the original bottom often are left so dry that they may fail to bond properly. In either case, that is, with an excess or a shortage of slag, the patch is weakened and eventually fails with the consequent loss of time, materials and perhaps metal.

The procedure under the liquid slag dumping method is simple. When the hole is cleaned of steel, it is given a shot of magnesite quickly before slag can gather, and then a second and perhaps a third dose of magnesite, if the hole is serious. Observation indicates that a safe dose of magnesite preceding the liquid slag application is not less than 5 nor more than 10 in. This dose should bring the level of the repair job up to where most of the dumped slag will drain away through gutters in the bottom and out of the taphole. The last few doses of magnesite are added with care and caution is used to see that they are well set and rounded to conform to the curvature of the rest of the bottom. Under this system the magnesite absorbs the correct quantity of slag and a higher temperature can be carried which is conducive to a firmer bond.

Foundry Plastic.—A special steelfoundry plastic for use in patterns and coreboxes for casting steel has been developed by Hull Steel Foundries, Limited, Hull, Quebec.

METALLURGICAL FACTORS OF IMPORTANCE TO THE PRACTICAL ALUMINIUM FOUNDER

Report of Practical Experience with Aluminium Alloys

By S. A. E. WELLS

(Continued from page 184)

DISCUSSION IN LONDON

Iron in L.33 Alloy

MR. W. A. JONES (Birmingham Branch) opening the discussion in London, referred to the iron pick-up of alloy L.33 from the iron pots, saying that a good deal of L.33 alloy had a high iron content; he had found that much depended on the length of time the material was left standing after modification. So far it seemed to him that, if the alloy had a high iron content, it must be left standing considerably longer than the period of from 4 to 7 mins., which was usual in the case of virgin material. He asked if Mr. Wells could confirm this.

The loss of magnesium when fluxing was another matter which interested him particularly. He had carried out a number of experiments on lines similar to those of Mr. Wells, with RR.50, but his figures did not quite bear out those given by Mr. Wells. He wondered how Mr. Wells' magnesium figures were estimated, for the method of estimation might have some influence. He added that he had found great difficulty in getting the magnesium out when he had wanted to do so, and that seemed to him to be rather strange.

Replying to a query by Mr. Wells as to the purport of his question concerning iron pick-up by L.33, MR. JONES said that in the Paper the tensile strength of the new material was given as about 11 tons per sq. in., whereas the figure for the material melted in the iron pot was 9 tons per sq. in. The grain size of the 9-ton material was large, and it appeared to be of similar type to the secondary L.33, having a high iron content. In his experience the tensile strength of the material was higher when the period during which the material was allowed to stand was increased. For example, with the virgin material, as illustrated by Mr. Wells, the grain size after about 3 mins. was quite large; but when the standing period was from 7 to 10 mins., the material had a fine silky structure.

"Grain Size" and Structure

MR. WELLS said there seemed to be a good deal of misapprehension as to what was meant by the term "grain size." The modification process was one of structural refinement, not of grain refinement; those two seemed often to be confused.

MR. JONES agreed, and said he was referring to the structure. As had been indicated in the Paper, the structure was influenced by the amount of iron in the material; but he felt that the structure could be altered by a longer waiting period during the modification.

MR. WELLS said he had noticed that, if the iron content were a little on the high side, there was a tendency for it to segregate in the areas showing the better modification. The experience was that such a long standing period was definitely detrimental, as shown by test results. The deterioration in the state of the modification due to prolonged standing appeared to accentuate the segregation of the iron as the well modified areas decreased.

MR. JONES commented that many investigators who had started with an alloy having a very high iron content had claimed that ultimately they had achieved a tensile strength of 11 tons per sq. in. in the alloy. He had found it possible to achieve high tensile strength only by waiting for a period.

MR. WELLS replied that one could secure the desired properties with an alloy having an iron content of 0.6 per cent., the maximum quoted in the specification. The alloy he had referred to in the Paper had contained 1 per cent. of iron. There was great difficulty in removing the last traces of magnesium from aluminium alloy; it was not difficult to reduce the magnesium content from large to quite small quantities, but the removal of the residual magnesium did present great difficulty. The task of determining the magnesium content was undertaken by the chemists, and he believed the method used was about as accurate as any. The determinations were made chemically, not spectrographically.

MR. HUDSON (J. Stone & Company) said that the phosphate method was used for determining the magnesium content; while it was not claimed that that method was infallible, he and his colleagues considered it to be the best method. To give full details would entail a long story, but he would be glad to help by discussing the matter further with Mr. Jones.

Casting Section and Grain Refinement

MR. F. HUDSON (Mond Nickel Company), after expressing his very deep appreciation of Mr. Wells' Paper, asked for more information concerning the effect of niobium and titanium as grain-refining elements in the production of light alloys. He sought information on the relation of casting section to grain refinement, and asked if Mr. Wells had found it necessary to apply grain refinement to die castings. Further, he asked if grain refinement were necessary in the production of heavy-section castings, in view of the fact that usually they were poured at a temperature below that at which coarsening arose.

MR. WELLS recalled that in the Paper he had stressed

Aluminium Founding

the importance of melting temperature in relation to the grain size of the castings. It stood to reason, he said, that if the founder did not exceed the critical temperature for a given alloy, the material could be kept fine; but the fact remained that it was very difficult, particularly in the case of die-castings, to keep the melting temperatures sufficiently low. Therefore, it was necessary to grain-refine when producing die-castings and chill castings. It had been noticed many times that when the metal had been somewhat maltreated and melted at a temperature higher than was essential, coarse grain had resulted when there was no grain refiner present; when one tried to cast into dies all sorts of cracking troubles occurred, and they could not be eliminated, owing to the inherent weakness of the coarse grain at the temperature just below the freezing point, when the non-giving nature of the metal die held up the casting so that it was not free to contract. The use of a grain refiner for alloys used for die-casting was certainly a great asset and was to be recommended.

The same considerations applied to the making of heavy-sectioned sand castings. If one were able, throughout the whole history of the metal, to keep the melting temperature low enough, one could produce a heavy casting having a reasonably good grain without the use of a grain refiner, by reason of the relatively low pouring temperature. But inasmuch as a grain refiner assisted by reducing shrinkage, helped to overcome feeding troubles, and so on, there was no question that the use of a grain refiner was of great advantage. His view was that all such alloys as he had discussed should carry a grain-refining constituent, whether the founder was sand-casting or die-casting heavy sections or light sections.

Pinholing Troubles

MR. F. A. HOULT (Kent Alloys, Limited) asked what was the relation between pinholing due to hydrogen pick-up and pinholing due to sodium modification. Speaking generally, would Mr. Wells blame hydrogen pick-up or sodium modification as the main cause of pinholing?

MR. WELLS said it was due to hydrogen pick-up every time.

MR. HOULT, who was asked to mention a particular case, said that even in a die-casting in L.33 there was pinholing, and he wondered whether hydrogen pick-up was responsible in that case.

MR. WELLS asked if Mr. Hoult usually found pinholing in L.33.

MR. HOULT replied that he did, in certain sections.

MR. WELLS said that it was due in the first instance to hydrogen in the metal, and the fact that pinholing did not show in some die-castings, *i.e.*, in the thinner-walled castings as distinct from the thick-walled castings, was controlled by the rate of cooling. Assuming that one were using the same metal for both, in the case of the thin-walled castings the gas was satisfactorily held in solution, whereas in the heavier section, by reason of the slower rate of cooling, the gas came out of solution and showed up as pinholes. The rate of solidification entered into the problem when gas was present.

D.T.D. 304

MR. HOULT, discussing melting conditions for D.T.D. 304 and methods of preventing hydrogen pick-up, asked if it were general practice to use electric furnaces and, if so, why could not D.T.D. 304 be produced satisfactorily in a bale-out furnace. Was the choice of furnace connected with the problem of hydrogen pick-up?

MR. WELLS replied that he had not experienced serious pinholing in D.T.D. 304, and he did not consider that gas pick-up was the greatest difficulty in connection with that alloy; there was not a great deal of trouble as a rule in producing D.T.D. 304 in a pinhole-free condition. One trouble was that the total impurities contained in the material must be controlled; and, further, the nature of the material was such that it was difficult to feed, and it was also difficult to avoid cracking. In his experience gas porosity was not a great source of trouble with D.T.D. 304, whether one used an electric furnace, a bale-out furnace or any other type.

MR. HOULT commented that he had not experienced serious pinholing in D.T.D. 304, but he had put the question as one of general interest, in order to secure information.

MR. WELLS added that it was quite easy to flux-treat the material in order to eliminate pinholing, if one were troubled with it.

MR. E. W. HALE said that founders who were using bale-out furnaces for melting D.T.D. 304 were not experiencing pinhole trouble in their castings. On the other hand, electric furnaces were used by a few founders who claimed that, due to the absence of water vapour in the melting chamber, there was no gas pick-up. If one used a furnace in which the metal was completely protected from the products of combustion, there could be very little risk of hydrogen pick-up by the metal.

Poor Feeding Causes Insidious Shrinkage

MR. RAYBOULT (Slough) confirmed Mr. Wells' statement that there was no undue gas porosity in D.T.D. 304; indeed, he believed that gas porosity was a little less in that alloy than in most others. He had expected some reference to D.T.D. 304, because there was a strong demand among designers for castings to replace forgings, and designers were looking to the high-strength alloys for that purpose. But the great bugbear which impressed the aluminium foundrymen in regard to the high-strength casting alloys was shrinkage. In the smaller castings the problem was relatively easy of solution, because there it was possible to achieve conditions of progressive solidification; but in the large castings there was increased difficulty, especially where sections were thick. If there was the

least fault in the mould design, shrinkage would occur, perhaps because the risers were not large enough or because progressive solidification could not be achieved. Shrinkage due to inadequate feeding was of a most insidious form, occurring probably throughout the casting; and he believed it contributed to cracking, because there were grain boundary weaknesses. The subsequent heat-treatment was a little drastic, so that if cracking did not occur before that, it was likely to occur afterwards. However, he would not contribute to the view that D.T.D. 304 was very prone to gas porosity, but emphasised that if the founders would take sufficient trouble they could overcome much of the difficulty.

The CHAIRMAN (Mr. R. B. Templeton) said that apparently Mr. Rayboult's opinion was that the difficulties were concerned more with foundry technique than with the metallurgical aspect.

Difficulties in Casting

MR. RAYBOULT replied that in respect of metallurgical conditions the high-strength casting alloys did not give the latitude that was given by some other alloys; the more ambitious foundrymen became to improve the properties of the high-strength castings alloys, the more difficulty there would be in casting components in them satisfactorily. But much of the difficulty could be overcome by the adjustment of foundry conditions, *e.g.*, the proper positioning of runners and risers, and the proper use of chilling effects. In die-castings, at least of the smaller types, there were not great difficulties, although again there was the liability to shrinkage and, of course, the metal was very hot-short and there was danger of the occurrence of manipulative cracking during the withdrawal of a casting from the die, more so than in many other alloys. He asked for Mr. Wells' opinion on that, because D.T.D. 304 was possibly the most popular high-strength casting alloy at the moment, or at any rate it had the greatest demand. He also asked how it compared with D.T.D. 300 (the 10 per cent. magnesium alloy), and whether Mr. Wells had found the latter more or less difficult to cast than D.T.D. 304.

MR. WELLS commented that D.T.D. 304 seemed popular on one side of the fence, but not on the other; the designer wanted it, but the founder did not. He agreed with Mr. Rayboult that it was possible, if one could give the necessary time to it, to produce good castings; but in view of the demand for production under present circumstances one could not give the necessary time to the production of complicated castings in alloys of the D.T.D. 304 type. He refrained from expressing a definite opinion as to the relative casting qualities of D.T.D. 304 and D.T.D. 300, for he had not done very much with D.T.D. 300, and such experience as he had had was not altogether plain sailing. But the casting of both alloys was difficult, and one needed considerable experience before one could get very far with them. It was true that the main difficulties with D.T.D. 304 were the cracking and shrinkage tendencies, and not gas porosity.

Melting Methods

MR. TURNER (Kent Alloys, Limited), reverting to Mr. Hoult's question concerning the melting of D.T.D. 304 in an electric furnace as compared with gas or oil or other types of furnace, said he was not quite sure whether or not Mr. Wells insisted that there was no more difficulty in melting the alloy in other types of furnace than in the electric furnace.

MR. WELLS replied that there was always danger of gas pick-up if the conditions were not too good; but, of course, that applied to all aluminium alloys. Electric furnace methods were the ideal, but few founders were able to use electric furnaces, and they must make the best of the facilities they had at hand. D.T.D. 304 did not present more difficulty in relation to gas pick-up than did other alloys.

MR. TURNER asked if there were more difficulty from the general point of view in melting D.T.D. 304.

MR. WELLS said that definitely there was not.

MR. HOULT covered his earlier remarks on the subject by emphasising that he was not troubled with gas porosity in D.T.D. 304, because he melted it in an electric furnace. He had succeeded in his purpose in raising the subject, which was to widen the discussion.

Cause of Porosity

MR. G. C. PIERCE (Past Branch-President), referring to L.33 alloy, asked if Mr. Wells still considered that porosity was due entirely to hydrogen, and not to the introduction of sodium.

MR. WELLS replied that he did. The ingot received by the founder probably contained quite a considerable amount of gas, and the whole trouble was probably due to hydrogen.

MR. W. A. JONES asked if he would rule out the suggestion that the porosity might be due to sodium vapour, bearing in mind the shape and colour of the holes, and so on.

MR. WELLS said that he would. He added that the crystallisation characteristics of Alpax type alloys were different from other alloys; that was why the cavities had a different shape.

MR. JONES commented that he had seen both types of hole in the same casting.

MR. WELLS said he still considered that the porosity was due to hydrogen.

MR. J. P. JONES asked for Mr. Wells' views concerning increased porosity at certain times of the year, due to the increased humidity of the atmosphere.

MR. WELLS agreed that it played a part; if humid atmospheric conditions prevailed for a lengthy period, gas troubles appeared to increase in the foundry. It seemed that it must revolve around the same point, that the water vapour would be decomposed, and the hydrogen picked up by the metal.

MR. JONES asked if that occurred after degassing, *i.e.*, during the very short period between de-gassing and pouring.

MR. WELLS would not go so far as to assert that that was so.

MR. G. C. PIERCE asked how far it was possible

Aluminium Founding

for hydrogen contamination to occur, due to pick-up from the oil fuel, when using an oil-fired furnace.

MR. WELLS replied that, when using a properly-controlled oil-fired furnace, there was not much danger of such contamination.

MR. A. J. MURPHY (Branch Vice-President), commenting on Mr. Wells' reference to contamination due to the entrainment and retention in the molten metal of non-metallic impurities, such as portions of refractory pots, and so forth, said that one came across isolated instances of it, and one wondered why, if it could occur once or twice, it did not occur more frequently. One suspected that the rather subtle surface tension effect was at work, as the result of which those particles of fireclay material, etc., would neither float nor sink in the metal. It would be interesting to hear Mr. Wells' views on that, as well as the experience of others.

Cast-Iron Pots

The CHAIRMAN asked what degree of contamination resulted from the use of a cast-iron melting pot, and if Mr. Wells could suggest any particular specification for the cast iron of which the pots were made, in order to minimise the danger of iron pick-up.

MR. WELLS replied that that depended on the temperature, the time and the maintenance or otherwise of the protective coating. Alloys which were sensitive to iron pick-up could be spoiled quite easily by damaging the protective coating, by bad manipulation of the stirring rod, and so on. The alloys had a great affinity for the iron. For the pots, ordinary grey cast iron, with the original casting skin left intact beneath the protective coating, afforded as good a protection as could be obtained. He did not think that heat-resisting irons had proved to be any better.

Minimum Temperature for Hydrogen Absorption

MR. HOULT asked what was the lowest temperature at which aluminium alloys would absorb hydrogen.

MR. WELLS replied that hydrogen was absorbed all the way up the temperature scale, once the metal was molten. The rate of absorption was very slow at the lower temperature, but at temperatures above 750 deg. C. it was necessary to be on the look-out for trouble. At 700 deg. C. the hydrogen pick-up was so slow and so small that, generally speaking, one had not to worry a lot. That was why, in respect of some alloys, 700 deg. C. was stated to be the optimum temperature; the purpose of stating that temperature was to avoid conditions favourable to hydrogen pick-up.

MR. HOULT said he had in mind the use of oil as a spray on mould surfaces in order to prevent the skin drying, and the absorption of hydrogen by the metal when it was flowing over sand which had a thin coating of oil.

MR. WELLS did not think that a lot of hydrogen was picked up by the alloys from the mould itself, except perhaps in the case of certain classes of alloys, such as the D.T.D. 300 type, having the higher magnesium contents. When casting such alloys one was usually forced to use special sands in order to counter the tendency to pick up hydrogen.

The CHAIRMAN recalled Mr. Rayboult's interesting comments on the matter, and asked whether alterations were made in the methods of gating and risering, according to the alloys concerned. Was there a wide divergence of practice in the methods of gating?

MR. WELLS replied that each alloy must be dealt with on its particular merits and characteristics. There was a fairly wide divergence in respect of the methods of gating as between one type of alloy and another. One would not deal with an alloy of the L.33 type in the same way as a high-strength material.

Vote of Thanks

MR. H. W. LOCKWOOD (Branch-President), who apologised for the fact that he was unable to reach London in time to preside at the meeting, and thanked Mr. Templeton for having stepped into the breach, proposed a hearty vote of thanks to Mr. Wells for his excellent Paper. Recalling the factors which had led to the meeting, he said that the London Branch, he believed, was the largest in the Institute, and the Branch Council, on analysing the membership, had appreciated that a quite large proportion of the members were concerned with non-ferrous founding. In consequence, a sub-committee was formed to arrange a programme of Papers. Mr. Wells had responded to the invitation to lecture, and there was no doubt that he was a unique lecturer; appreciation of the service he had rendered could not have been better shown than by the fine attendance at the meeting.

DR. A. B. EVEREST, seconding, commented jocularly that to him, as one concerned mainly with the ferrous side of the industry, the meeting had been a source of some consolation. The ferrous founders talked about blowholes in cast iron, and perhaps they had come to regard themselves as being on a lower plane than the non-ferrous founders. But, having listened to Mr. Wells' Paper and the discussion upon it, there seemed to be as many kinds of blowholes in aluminium as in cast iron! However, the Paper had been most interesting, and the members of the Branch were most appreciative.

The vote of thanks was accorded with acclamation, and Mr. Wells assured the meeting that the preparation and presentation of the Paper had afforded him great pleasure.

MR. HOULT said he would endeavour to persuade a colleague to present a short lecture on D.T.D. 304 alloy. To do so might appear to be inviting an avalanche; but the avalanche might be of interest, and he would undertake to exhibit various samples and X-ray photographs which had been produced during the past few months. Commenting on the comparisons made between the problems of ferrous and non-ferrous founding, Mr. Hoult said that perhaps the non-ferrous founders had greater opportunity of finding out their faults, when they had to produce Class I castings which were subjected to examination by the A.I.D. radiological technique.

(To be continued.)

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THE STANTON IRONWORKS COMPANY LIMITED
NEAR NOTTINGHAM.

NOTES FROM THE BRANCHES

WEST RIDING OF YORKS

A visitor to the opening meeting of the session of the West Yorks Branch was Mr. Eardley, Regional Engineer for the Ministry of Fuel and Power, who came by invitation of Mr. W. G. Thornton, chairman of the East and West Ridings Ironfounding Industry Fuel Committee.

Introducing Mr. Eardley, MR. THORNTON stressed the need for economy in the use of all classes of fuel in the foundries. He explained a method the Fuel Committee had adopted so as to help foundries to attain the highest possible efficiency without endangering the final product—the castings—and said his committee were distributing to all foundries in the area copies of Form F.9, asking for various particulars in connection with their melting units, core stoves, etc. On completion these forms should be returned to the committee, who would analyse them and report to the firms with suggestions wherein, in the committee's opinion, economy might be achieved. Mr. Thornton emphasised the importance of filling up these forms correctly and asked that, wherever possible, the members of the Institute should deal with the matter personally.

MR. EARDLEY thanked the President of the Branch (Mr. L. Turner) and the members for the opportunity to speak to the Branch on this subject. He had that afternoon attended a meeting of the East and West Ridings Fuel Committee of the industry, where reports of some of the visits the members had undertaken were presented, and he was greatly impressed by the methods and procedure adopted and the savings that could be effected by systematic control. It was the intention of his department, he said, eventually to visit all foundries, and he explained that a member of the Panel would accompany the visiting engineer.

The majority of the members of this Panel were members of the Institute of British Foundrymen and practical foundrymen. Foundrymen were more fortunate than most industries in so far as their main fuel was coke. Up to the moment there had been no shortage of this type of fuel, but that was no reason why it should be wasted or why ways and means should not be adopted to economise wherever possible. Mr. Eardley quoted figures which had recently appeared in the Press giving output and consumption of fuel, and said it did not need much imagination to see how we should be situated before the winter was through unless some drastic improvements took place in that respect. His department and the East and West Ridings Fuel Committee were concerned with making the best possible use of the fuel available, and he hoped the members of the Institute would help this committee in the work it was doing by complying with the requests made to them through the committee.

New Members

Mr. W. E. Mather, of Davy & United Engineering Company, Limited, shown as an Associate member in the list of new members in our last issue, was elected a full member at the last Council meeting of the Institute.

DORMAN LONG CAPITAL

NEW ISSUE OF ORDINARY SHARES

Circulars have been sent by Dorman, Long & Company, Limited, to the holders of their preferred ordinary and ordinary shares inviting them to subscribe to the new issue of ordinary shares.

As already explained, the directors of the company have decided to pay off on January 17, 1944, the company's 5 per cent. mortgage redeemable debenture stock, which requires £3,183,138 including the 5 per cent. premium payable on redemption. Interest to date of redemption will also be paid. Towards this repayment of the 5 per cent. debenture stock and to free the charges on the company's properties, assets and profits, 2,094,334 new ordinary shares of £1 each (part of the unissued share capital) are offered, in the first instance, for subscription at 27s. per share to the holders of the preferred ordinary shares and/or ordinary shares of the company alone, in the proportion of one new ordinary share for each preferred ordinary share and/or ordinary share held. The balance required for such repayment will be provided out of the company's cash resources.

The directors point out that since the reorganisation of the company's capital in 1934 the business has prospered and the financial position of the company has been progressively strengthened. Dividends on the ordinary shares were paid for the year ended September 30, 1936, at the rate of 6 per cent., and for each of the three following years at the rate of 10 per cent. Owing to adverse conditions outside the company's control, the dividend for the year to September 30, 1940, was reduced to 7 per cent., and no dividend was paid for the following year. In 1942 conditions improved, and a dividend for that year was paid at the rate of 8 per cent. The company, which is fully engaged on work of national importance, occupies a leading position in the iron and steel industry, and with its subsidiaries, Redpath, Brown & Company, Limited, and the Tees Side Bridge & Engineering Works, Limited, forms one of the largest groups of structural engineers in the country. The improved trading conditions which resulted in increased profits for the year ended September 30, 1942, as compared with 1941, have been fully maintained during the whole of the year to September 30, 1943. The final results for the year just ended will be known early next year.

Repayment and discharge of the 5 per cent. debenture stock will improve the capital structure of the company and therefore the value of the ordinary shares, the circular points out.

CONTRACT OPEN

Any date given is the latest on which tenders will be accepted. The address is that from which tender forms may be obtained.

Motherwell—200 metal bedsteads, for the Town Council. The Burgh Factor, 117, Brandon Street, Motherwell. The Council is in a position to furnish a certificate for the acquisition of the metal required.

MINISTRY OF SUPPLY

RUBBER IS SCARCE

DAMAGE THAT MUST BE PREVENTED

Dig embedded flints, glass, nails, etc., out of your tyres every day. Otherwise they will work through the tread into the casing and destroy tyres that *might* have been saved for retreading.

Check air pressure every day. Under-inflated tyres over-flex and over-heat while running. This causes rapid rupture of the fabric.

Bumping over kerbs and big stones rapidly grinds away the fabric. Scraping along kerbs subjects a tyre to damage at its weakest point—the tyre walls.

SUBMIT TYRES FOR REPLACEMENT WHEN SMOOTH

PERSONAL

SIR JAMES MARCHANT has resigned through ill-health from the directorate of the Salvage and Recovery Board of the Ministry of Supply.

MR. WILLIAM TURNBULL, manager of the Blyth Dry Docks & Shipbuilding Company, and MR. ALAN GRAIG, secretary, have been elected to the board of directors.

MR. RICHARD F. SUMMERS, chairman of John Summers & Sons, Limited, and a director of the United Steel Companies, Limited, has been appointed a director of the L.M.S. Railway.

PILOT-OFFICER THE HON. JOHN GRIMSTON, who recently was elected M.P. for St. Albans, is a director of Enfield Rolling Mills, Limited, and its subsidiaries. He is the son of Lord Verulam.

MR. S. MCEWEN has been appointed honorary treasurer and vice-president of the Combustion Appliance Makers' Association in succession to Mr. E. W. Robey, who has retired for reasons of health.

MR. H. LINDARS has been nominated by the Combustion Appliance Makers' Association for re-election as chairman of the council of the British Coal Utilisation Research Association for the three years ending December, 1946.

MR. PETER BOULTON has been released by the Minister of Supply from his appointment as honorary adviser to the Director of Hand Tools on the Agricultural and Heavy Edge Tool Section at the request of his firm. The panel will continue under the chairmanship of the Director of Hand Tools.

SIR MALCOLM FRASER, BT., has been elected chairman of Callender's Cable & Construction Company, Limited, and also of the Anchor Cable Company, Limited. He was elected director of these two companies in 1923, and has taken an active part in their development. Sir Malcolm Fraser was created a Baronet in 1921, and received the G.B.E. in 1923. He has been Lord-Lieutenant of the County of Surrey since 1939. Sir Malcolm was director of Aircraft Construction at the Admiralty for a period during the last war.

MR. ARTHUR BRAMPTON told the annual meeting of the Renold & Coventry Chain Company, Limited, that he had decided to relinquish his chairmanship of the company, and had tendered his resignation to the board, who had appointed the managing director, MR. C. G. RENOLD, to the chairmanship in his stead. Mr. Brampton is retaining his seat on the board; he has filled the office of chairman since the formation of the company in 1930, when Hans Renold, Limited, the Coventry Chain Company, Limited, and Brampton Bros., Limited, were merged. Mr. C. G. Renold is resigning his position as managing director, and the board has appointed MR. R. O. HERFORD to that position. Mr. Herford, who has been works director for many years, has been loaned by the company to the Ministry of Supply as Controller of Inspection (Administration), which position he at present holds. He will assume the duties of managing director as soon as he is released by the Government.

COMPANY RESULTS

(Figures for previous year in brackets)

Manley & Regulus—Interim dividend of 5% on the ordinary shares (same).

Garrard Engineering & Manufacturing—Interim dividend of 12½% (same).

R. & W. Hawthorn, Leslie—Final dividend of 7% and a bonus of 5%, making 15% (same).

Cornercroft—Net profit for the year to June 18, 1943, £47,414; ordinary dividend of 15%; forward, £3,838.

Bentley Engineering—Net profit for 1942, £14,606 (£15,026); preference dividend, £5,700 (same); ordinary dividend of 10% (15%), tax-free, £4,500 (£6,750); forward, £15,911 (£12,538).

Thos. W. Ward—Net profit for the year ended June 30, £116,982 (£134,884); to employees' benevolent fund, £5,000; final dividend of 6¼% on the ordinary shares, making 10% (11¼%); to reserve £15,000 forward, after preference dividends, £128,960 (£127,891).

Crabtree Electrical Industries—Final dividend of 5% and a cash bonus of 7½% on the ordinary shares, making 17½% (same) for the year ending October 31. The trading profit of the operating company for the year ended July 31 amounted to £244,272 (£225,727) and the net profit to £53,305 (£111,390).

Wright, Bindley & Gell—Net profit for the year ended June 26, £11,969 (£10,636); dividend of 7% on the preferred ordinary shares, £8,690 (same); additional dividend of ¾d. per share, £388 (same); dividend on the deferred shares of 2d. per share, £1,135 (same); to reserve fund, £2,000; forward, £1,971 (£2,244).

OBITUARY

MR. ARTHUR PEXALL KIDSON, a director of Glaholm & Robson, Limited, wire manufacturers, Sunderland, died recently, aged 83.

FLIGHT-LIEUTENANT ERNEST A. POWRIE, of Dundee, has been killed on active service. He was managing director of Alfred E. Powrie & Son, Limited, metal merchants, and was interested in several other firms.

MR. GEORGE ALBERT FORSGATE has died at his home at Totley, Sheffield, aged 54. He was a director of Standall Engineering, Limited, and was formerly associated in Colonial trade with Hardypick, Limited.

MR. HAROLD HIGGINS, managing director of the Yorkshire Engineering Supplies, Limited, Leeds, died recently. He was one of the trustees and a very active member of the council of the Association of Bronze and Brass Founders.

MR. J. J. A. JONES, manager of the Central Research Department of the United Steel Companies, Limited, Stocksbridge, has died, aged 49. He took an active part in the affairs of the Sheffield Metallurgical Society. He graduated at the University of Wales, and served in France in the early part of the last war, being seconded from the Army in 1917 to act as research metallurgist at Woolwich Arsenal.

Tungum ALLOY may be the KEY!

"Tungum" Brand Alloy is solving problems in all sections of industry because of the special characteristics inherent in the metal and the ease with which it can be machined.
Wherever the strength-to-weight factor has to be considered; where ductility and resistance to torsional fatigue are important; where resistance to corrosion is essential, "Tungum" is worthy of consideration. It may be the key to *your* problem.
Our Technical Department is at your service and will gladly give information and advice on any problem submitted.

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Tungum Alloy is described in Technical Data Sheets under headings—Tubing; Rod and Bar; Sheet and Strip; Wire; Cables, Gauzes and Springs; Castings; Pressings. They are available free on request.

TUNGUM SALES CO. LTD.
Brandon House, Painswick Road, Cheltenham, Glos.

150 lbs. of Phosphor Bronze in 23 mins.

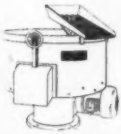
Rapid melting

Low first cost

Quickly installed

Entirely self-contained, complete with its own fan and motor, the "Polford" Crucible Furnace for melting non-ferrous metals is low in cost, efficient and economical in service. The hopper, through which the crucible is charged, acts as a pre-heater, ensuring rapid fusing. Any make of crucible can be used. The furnace is made in various sizes from 60 lbs. to 300 lbs. capacity—coke or oil.

Ask for full details.



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"POLFORD"
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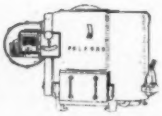
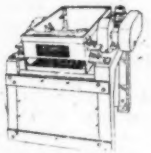


PORTABLE MOULD DRYER



VIBRATORY SCREEN

THE HEATON FOUNDRY CO. LTD.
Makers of Foundry Equipment,
HEATON JUNCTION, NEWCASTLE UPON TYNE, 6

CONTROL OF IRON AND STEEL

HIGHER PRICES FOR RAINWATER GOODS

The Minister of Supply has made the Control of Iron and Steel (No. 32) Order, 1943, which came into force on November 3. It revokes and remakes in consolidation form the Control of Iron and Steel (Nos. 15-20, 22, 23, 26, 28 and 31) Orders, 1941-3. The Order also includes the following new provisions:—

(1) Extension of control to niobium and tantalum ores and all chemical compounds of molybdenum, tungsten or vanadium (exclusive of catalysts or pigments).

(2) Permits stockholding merchants to prepare material supplied against an authorisation under the distribution scheme to the extent covered by that authorisation. In other cases stockholders may perform simple operations such as cutting and holing.

(3) Where a re-sale is made at the request of the Minister of Supply involving additional transport costs, he may authorise an addition to the maximum controlled price.

(4) Permits the purchase without authority of up to 2 rolls, not exceeding £3 in value, of used wire netting in any calendar month.

The Order also authorises a number of price changes in the Related Schedules. For the most part the changes in the Schedules are confined to the editing of the wording and the clearer definition or revision of extras and few are of direct interest to the foundry trade. An important exception is that the prices for the products covered by Related Schedules 91-95, inclusive, are all increased by means of a higher percentage (*viz.*, 32½ per cent.), named in the Fifth Schedule to the new Order. These five Related Schedules all refer to iron castings and are as follow:—

91.—Rainwater and soil pipes and gutters (England, cotland and Wales).

92.—Box boundary wall, trough boundary wall, centre and trough centre gutters up to ⅞ in. thick (England, Scotland and Wales).

93.—As 92 (Northern Ireland).

94.—As 92, up to ¼ in. thick, England, Scotland, Wales and Northern Ireland.

95.—Rainwater, soil and gutter connections.

Related Schedule No. 93 establishes maximum prices for Northern Ireland for the first time, while Nos. 94 and 95 extend existing prices to Northern Ireland.

Increased prices also are established for cast-iron drain pipes to B.S.S. 437 (Related Schedule No. 64), cast-iron drain pipe fittings (No. 65) and angle cast-iron pipes for gas and water purposes (No. 66).

Copies of the Order may be obtained from H.M. Stationery Office, or through any bookseller, price 4d. (S. R. & O., 1943, No. 1530.)

READERS WHO DESIRE 1944 refills for their Stewarts and Lloyds, Limited, popular desk calendars should send a penny stamp to the Publications Department, Winchester House, Old Broad Street, London, W.C.2.

NEWS IN BRIEF

MR. GEORGE BUCHANAN, M.P. for the Gorbals division of Glasgow, has been re-elected National President of the United Patternmakers' Association.

THE MINISTRY OF LABOUR AND NATIONAL SERVICE have made available to the Board of Trade the part-time services of Mr. R. J. Humphreys, their regional controller in Wales, for work on industrial reconstruction problems in that area.

THE WEST RIDING EDUCATION COMMITTEE has approved a proposal of a sub-committee that, as an experiment, the local authority co-operate with the United Steel Companies, Limited, Stocksbridge, in the establishment of a Young People's College for employees of the firm.

TWO CONFERENCES are to be held by local authorities on Tyneside in the near future to consider the industrial position after the war. The Mayor of Tynemouth has called a conference for November 8, while Lord Ridley proposes holding a conference at Newcastle on December 1. Lord Ridley, in a circular letter to local authorities, said there was a fear that after the war there would be widespread unemployment in the North-East.

HORSELEY BRIDGE & THOMAS PIGGOTT, LIMITED, constructional engineers and ironfounders, are issuing 112,500 10s. ordinary shares, which are offered at 19s. each to shareholders in the proportion of one for every four held. Treasury consent has been obtained for the issue which is made with the object of providing additional permanent capital for financing increased business and for extensions to buildings and plant as may be required.

MR. R. A. BUTLER, President of the Board of Education, speaking in London, said that his recent tours of Tyneside, Merseyside, and elsewhere had convinced him of the need for a drive for improved technical education immediately after the war. This should take high precedence in the programmes of the education authorities. It was the intention of the Government to proceed with the development of technical and adult education as quickly as possible.

NEW TRADE MARKS

The following applications to register trade marks appear in the "Trade Marks Journal":—

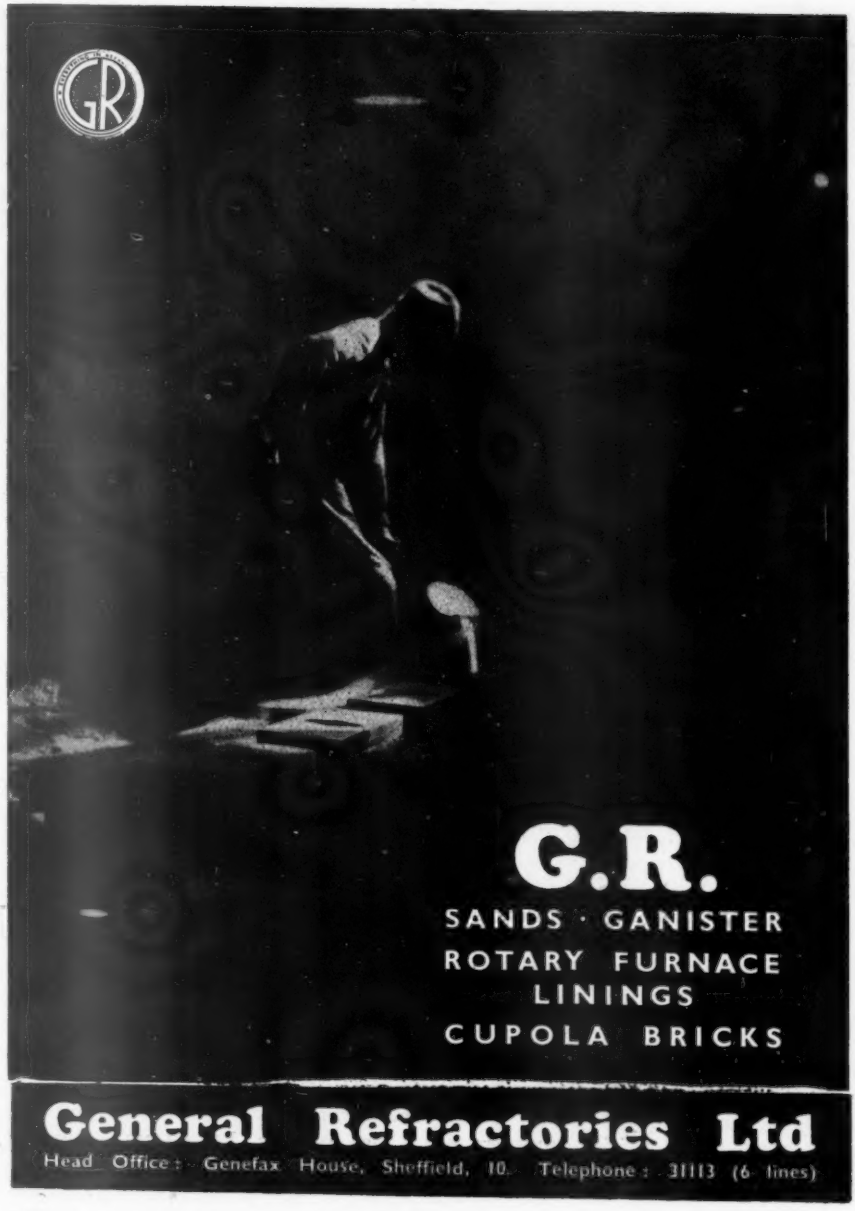
"BAMFORDS"—Agricultural machinery. BAMFORDS, LIMITED, Leighton Iron Works, Spiceal Street, Uttoxeter.

"NEVELIN"—Mercury-arc electric current rectifiers, etc. NEVELIN ELECTRIC COMPANY, LIMITED, Purley Way, Croydon, Surrey.

"AIPITE"—Asbestos. ASBESTOS INDUSTRIAL PRODUCTS (BRIGHOUSE), LIMITED, Gasket Works, Branston Street, Brighouse, Yorks.

"WRODLE"—Fences and hurdles—of common metal. CARDON & COMPANY, LIMITED, Chespale Works, Penshurst, Kent.

"E.F.E."—Electric switches, switch sockets and plugs. E.F. ENGINEERING PRODUCTS, LIMITED, Harford House, Carey Place, Watford.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Raw Material Markets

IRON AND STEEL

The inactivity in the light-castings trade is reflected in the limited demand for high-phosphorus pig-iron, licences for which are freely obtainable. As far as possible these establishments are supplementing the output of special engineering castings, production of which has been facilitated by a more liberal distribution of low- and medium-phosphorus iron and refined iron. Hematite iron is still scarce, the Control evidently deeming it prudent to conserve supplies for authorised purposes. But it has recently been disclosed that another mine has been opened on the West Coast and the increased output of hematite ore should exercise a favourable influence on the available tonnages of this class of iron. It is, indeed, only in hematite that any real shortage exists at the moment. For a long period there was constant pressure from the engineering foundries for medium-phosphorus and low-phosphorus grades of iron, but the demand has lately shown a decline and some foundries are not taking up their full allocations. A reflection of the position is the notification by the Control that, as from November 27, they do not propose to nominate specific makers on their licences to consumers to acquire low-phosphorus pig-iron, leaving it for the individual foundries to make their own arrangements. At the same time, the hope is expressed that foundries will keep transport questions in mind and purchase supplies from the nearest maker.

The demand for refined iron also has eased in recent weeks, and some of the makers would welcome new business. The decline in the demand is relative only, but it is none the less evident; though it is equally evident that a great many of the foundries are still very busily engaged and committed for a long time ahead for castings in connection with important Government contracts. The Minister of Production intimated some time back that changes in the production programme would result in less employment in certain directions while the new contract allocations were being worked out, and probably the slacker conditions at some of the foundries are a reflection of the changes that are taking place.

There is no change in regard to foundry coke. Good supplies are available from the usual sources of supply. Foundries possessing stocking accommodation filled up their space during the summer months. Good supplies are now coming forward at a regular rate to meet the foundries' immediate requirements. Limestone is now much freer and current deliveries are sufficient to meet day-to-day requirements.

On the whole, the foundries are getting all the scrap iron and steel they require, though supplies are less readily available in some parts of the country than they are in others.

Coming to the steel side, activity everywhere is fully maintained. Employment at the re-rolling mills is on such a scale as to ensure the ready absorption of the full quotas of steel semis provided by the steelmakers and also any re-rollable material in the form of defectives, crops, etc., which may become available. There is, however, an abundance of sheet bars, which is probably due to the employment of some of the sheet mills in the rolling of thin plates for the shipyards.

Apart from the heavier sizes of sections, the demand for structural steel is undiminished. Bookings for steel plates and light and medium sections, small bars, etc., extend well into next year and the high activity of the shipbuilding, boiler-making and engineering trades ensures full-scale activity throughout the winter. The improvisations of war have greatly swollen the uses of sheets of all gauges for a wide variety of purposes from shipbuilding to Nissen huts and containers,, and although little galvanising is possible, the mills have rolling programmes which will keep them busy for many months to come. Tube makers are almost bare of stocks and have big orders in hand. So, too, have the wire drawers and rivet makers. Collieries are calling for more steel for roofing purposes.

NON-FERROUS METALS

Tin continues to be issued sparingly. There are some purposes, of course, for which its use is essential, but substitutes must be utilised wherever practicable. It is possible that a little more export business in tinplates may be permitted, which would involve a slight increase in tin consumption, but it is obvious that the utmost economy in the use of the metal must be observed so long as the United Nations are denied access to Eastern deposits.

There is little change in the copper position. The rather easier conditions noted in recent months continue, and it is evident that consumption in some quarters is lighter than it has been at any time during the last two years. Quiet conditions continue in the market for brass scrap.

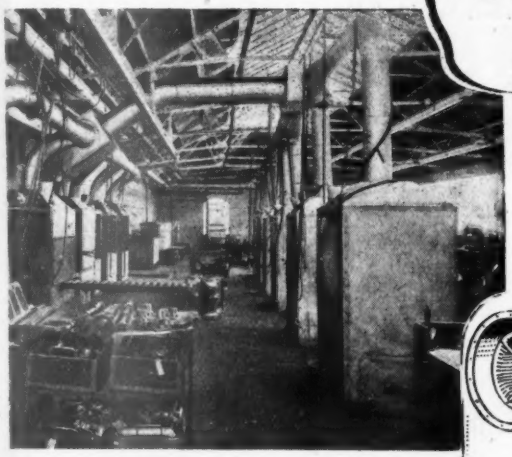
The supply position in spelter is relatively good and consumers engaged on war production have no difficulty in filling their requirements. It is evident, however, that the authorities do not intend to relax restrictions on the use of the metal. The same policy is evident as regards lead, which, in all the circumstances, is in good supply. The shipping position is a dominating factor still in connection with both lead and zinc, for metal and concentrates have to be brought long distances by sea.

Available supplies of aluminium and other light metals are readily absorbed by aircraft manufacturers and similar essential users and there can be no hope just yet of any substantial quantity being released for ordinary civilian purposes.

The (American) War Production Board has formed the Aluminium Foundry Industry Advisory Committee.

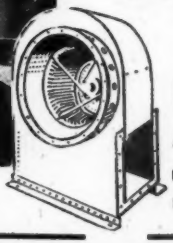
The American Foundrymen's Association have empanelled about 400 of their members to serve on well over one hundred national committees.

DUST REMOVAL FROM *Castings*



A battery of cabinets for cleaning castings, the dust being extracted by a "Sirocco" Fan.

"SIROCCO" Dust Removal Plant is undoubtedly one of the most successful methods of cleaning castings. The "fettling" or "dressing" process is an extremely dusty operation, and the provision of a "Sirocco" Plant effects a considerable improvement in working conditions which materially assists towards higher efficiency and increased output.



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CURRENT PRICES OF IRON, STEEL AND NON-FERROUS METALS

(Delivered, unless otherwise stated)

Wednesday, November 10, 1943

PIG-IRON

Foundry Iron.—CLEVELAND No. 3: Middlesbrough, 128s.; Birmingham, 130s.; Falkirk, 128s.; Glasgow, 131s.; Manchester, 133s. DERBYSHIRE No. 3: Birmingham, 130s.; Manchester, 133s.; Sheffield, 127s. 6d. NORTHANTS No. 3: Birmingham, 127s. 6d.; Manchester, 131s. 6d. STAFFS No. 3: Birmingham, 130s.; Manchester, 133s. LINCOLNSHIRE No. 3: Sheffield, 127s. 6d.; Birmingham, 130s.

(*No. 1 foundry 3s. above No. 3. No. 4 forge 1s. below No. 3 for foundries, 3s. below for ironworks.*)

Hematite.—No. 1 (S & P 0.03 to 0.05 per cent.): Scotland, N.-E. Coast and West Coast of England, 138s. 6d.; Sheffield, 144s.; Birmingham, 150s.; Wales (Welsh iron), 134s. East Coast No. 3 at Birmingham, 149s.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, 140s. 6d., delivered Birmingham.

Scotch Iron.—No. 3 foundry, 124s. 9d.; No. 1 foundry, 127s. 3d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, 174s.; South Zone, 176s. 6d.

Refined Malleable.—North Zone, 184s.; South Zone, 186s. 6d.

Cold Blast.—South Staffs, 227s. 6d.

(NOTE.—*Prices of hematite pig-iron, and of foundry and forge iron with a phosphoric content of not less than 0.75 per cent., are subject to a rebate of 5s. per ton.*)

FERRO-ALLOYS

(*Per ton unless otherwise stated, basis 2-ton lots, d/d Sheffield works.*)

Ferro-silicon (5-ton lots).—25 per cent., £21 5s.; 45/50 per cent., £27 10s.; 75/80 per cent., £43. Briquettes, £30 per ton.

Ferro-vanadium.—35/50 per cent., 15s. 6d. per lb. of V.

Ferro-molybdenum.—70/75 per cent., carbon-free, 6s. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, 1s. 3½d. lb.

Ferro-tungsten.—80/85 per cent., 9s. 8d. lb.

Tungsten Metal Powder.—98/99 per cent., 9s. 9½d. lb.

Ferro-chrome.—4/6 per cent. C, £59; max. 2 per cent. C, 1s. 6d. lb.; max. 1 per cent. C, 1s. 6½d. lb.; max. 0.5 per cent. C, 1s. 6¾d. lb.

Cobalt.—98/99 per cent., 8s. 9d. lb.

Metallic Chromium.—96/98 per cent., 4s. 5d. lb.

Ferro-manganese.—78/98 per cent., £18 10s.

Metallic Manganese.—94/96 per cent., carb.-free, 1s. 9d. lb.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms and Slabs.—BASIC: Soft, u.t., 100-ton lots, £12 5s.; tested, up to 0.25 per cent. C, £12 10s.; hard (0.42 to 0.60 per cent. C), £13 17s. 6d.; silico-manganese, £17 5s.; free-cutting, £14 10s. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £15 15s.; case-hardening, £16 12s. 6d.; silico-manganese, £17 5s.

Billets, Blooms and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £13 17s. 6d.; basic hard, 0.42 to 0.60 per cent. C, £14 10s.; acid, up to 0.25 per cent. C, £16 5s.

Sheet and Tinplate Bars.—£12 2s. 6d., 6-ton lots.

FINISHED STEEL

[*A rebate of 15s. per ton for steel bars, sections, plates, joists and hoops is obtainable in the home trade under certain conditions.*]

Plates and Sections.—Plates, ship (N.-E. Coast), £16 3s.; boiler plates (N.-E. Coast), £17 0s. 6d.; chequer plates (N.-E. Coast), £17 13s.; angles, over 4 un. ins., £15 8s.; tees, over 4 un. ins., £16 8s.; joists, 3 in. × 3 in. and up, £15 8s.

Bars, Sheets, etc.—Rounds and squares, 3 in. to 5½ in., £16 18s.; rounds, under 3 in. to ¼ in. (untested), £17 12s.; flats, over 5 in. wide, £15 13s.; flats, 5 in. wide and under, £17 12s.; rails, heavy, f.o.t., £14 10s. 6d.; hoops, £18 7s.; black sheets, 24 g. (4-ton lots), £22 15s.; galvanised corrugated sheets (4-ton lots), £26 2s. 6d.; galvanised fencing wire, 8g. plain, £26 17s. 6d.

Tinplates.—I.C. cokes, 20 × 14 per box, 29s. 9d., f.o.t. makers' works, 30s. 9d., f.o.b.; C.W., 20 × 14, 27s. 9d., f.o.t., 28s. 6d., f.o.b.

NON-FERROUS METALS

Copper.—Electrolytic, £62; high-grade fire-refined, £61 10s.; fire-refined of not less than 99.7 per cent., £61; ditto, 99.2 per cent., £60 10s.; black hot-rolled wire rods, £65 10s.

Tin.—99 to under 99.75 per cent., £275; 99.75 to under 99.9 per cent., £276 10s.; min. 99.9 per cent., £278 10s.

Spelter.—G.O.B. (foreign) (duty paid), £25 15s.; ditto (domestic), £26 10s.; "Prime Western," £26 10s.; refined and electrolytic, £27 5s.; not less than 99.99 per cent., £28 15s.

Lead.—Good soft pig-lead (foreign) (duty paid), £25: ditto (Empire and domestic), £25; English, £26 10s.

Zinc Sheets, etc.—Sheets, 10g. and thicker, ex works, £37 12s. 6d.; rolled zinc (boiler plates), ex works, £35 12s. 6d.; zinc oxide (Red Seal), d/d buyers' premises, £30 10s.

Other Metals.—Aluminium, ingots, £110; antimony, English, 99 per cent., £120; quicksilver, ex warehouse, £68 10s. to £69 15s.; nickel, £190 to £195.

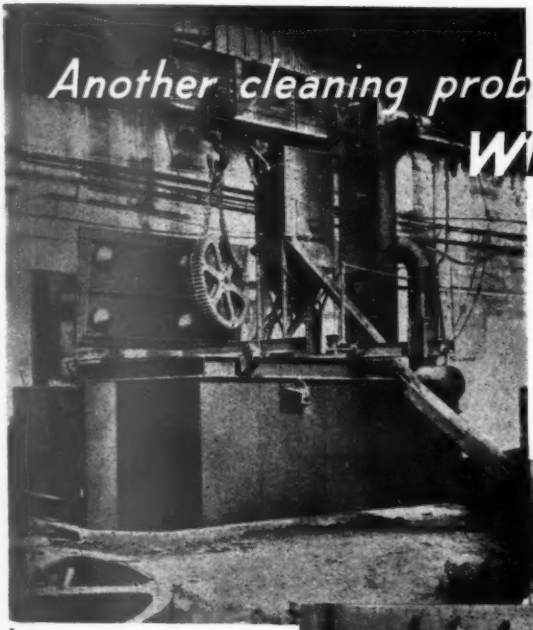
Brass.—Solid-drawn tubes, 14d. per lb.; brazed tubes, 16d.; rods, drawn, 11¾d.; rods, extruded or rolled, 9d.; sheets to 10 w.g., 10¾d.; wire, 10¼d.; rolled metal, 10¼d.; yellow metal rods, 9d.

Copper Tubes, etc.—Solid-drawn tubes, 15¼d. per lb.; brazed tubes, 15¼d.; wire, 10d.

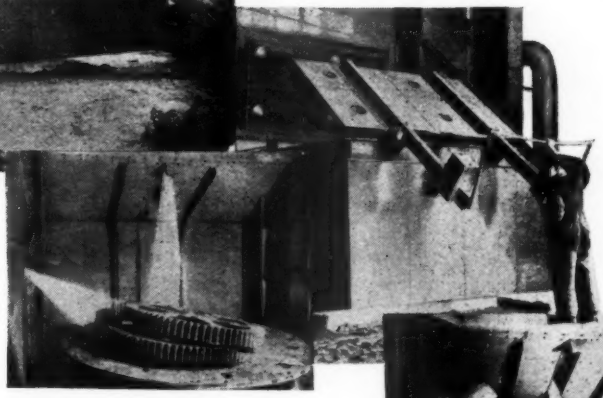
Phosphor Bronze.—Strip, 13¾d. per lb.; sheets to 10 w.g., 14¾d.; wire, 16d.; rods, 16d.; tubes, 21¼d.; castings, 19d., delivery 3 cwt. free. 10 per cent. phos. cop. £35 above B.S.; 15 per cent. phos. cop. £43 above B.S.; phosphor tin (5 per cent.) £40 above price of English ingots. (C. CLIFFORD & SON, LIMITED.)

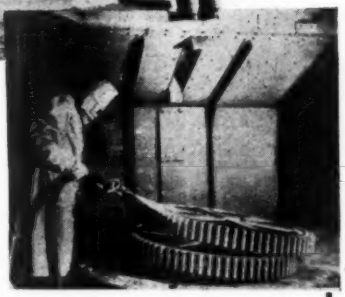
Nickel Silver, etc.—Ingots for raising, 10d. to 1s. 4d. per lb.; rolled to 9 in. wide, 1s. 4d. to 1s. 10d.; to 12 in. wide, 1s. 4¼d. to 1s. 10¼d.; to 15 in. wide, 1s. 4¼d. to 1s. 10¼d.; to 18 in. wide, 1s. 5d. to 1s. 11d.; to 21 in. wide, 1s. 5¼d. to 1s. 11¼d.; to 25 in. wide, 1s. 6d. to 2s. Ingots for spoons and forks, 10d. to 1s. 6¼d. Ingots rolled to spoon size, 1s. 1d. to 1s. 9¼d. Wire round, to 10g., 1s. 7¼d. to 2s. 2¼d., with extras according to gauge. Special 5ths quality turning rods in straight lengths, 1s. 6¼d. upwards.

Another cleaning problem solved by a WHEELABRATOR



The Problem: To clean in a few minutes, large cored and intricate steel castings. *The Answer!* A room with two Wheelabrator wheels, one throwing the abrasive vertically, the other horizontally, on to the castings which are readily lowered by the crane through the roof. Any hidden parts not perfectly clean are then touched up by a Sandblaster. *Result:* 100% efficiency.





1. Castings being lowered through roof (the near half of which is closed to give better view) on to the revolving table in the room.
2. The operator closes the counterbalanced roof without effort. Roof doors are sealed when closed; dust is exhausted at necessary points.
3. Castings being subjected to intensive automatic abrasion as the turntable revolves under the streams of shot from the Wheelabrator wheels.
4. The Sandblaster in protective clothing and receiving clean air, then touches up the very few hidden parts not reached by the thrown abrasive.

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